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ABSTRACT

This evaluation report is the second in a series addressing the development of the Ohio SchoolNet Telecommunity initiative. Overarching topics for evaluation inquiry include technology deployment, practices in professional development, and impacts of network use on students and teachers. The report is organized by 14 "most frequently asked questions": (1) What criteria are generally used to identify successful distance education? (2) Which projects are using distance learning technologies optimally? (3) Are there common elements in projection implementation? (4) How do different models of distance education compare? (5) Are the projects on track with regard to timelines, hardware acquisition, professional development, and content? (6) Are projects migrating to higher standards? (7) Were planning grants helpful in building a guiding coalition and building capacity for the work? (8) What impacts on student learning is the Telecommunity project responsible for? (9) What impacts on teachers and teaching is the Telecommunity initiative having? (10) Are we developing assessment tools to assess student learning effectively? (11) What does the professional development picture at Telecommunity implementation sites look like and is it sufficient? (12) Is distance learning cost-effective in the Telecommunity sites? (13) Is distance learning promoting equity within the Telecommunity sites? and (14) How are Telecommunity sites leveraging existing technology resources and what are the outcomes? As a comparative resource, this evaluation report also profiles two other projects OWLink in Houston (Texas) and the St. Louis (Missouri) School District that are using two-way, interactive communications technologies to improve student learning. This report contains several tables and figures. (JAK)

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The Ohio SchoolNet Telecommunity Evaluation

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Introduction

As one of Ohio's major educational technology initiatives, the Telecommunity project seeks to improve the communication capacity of participating schools through two-way interactive distance technologies. Three overarching goals guide the development of the Telecommunity initiative: deployment (i.e., the dissemination and distribution of videoconferencing technologies), professional development, and student impact. These objectives for employing network-video technology in the classroom have been in place throughout the three years of the project. The goals also bear a close resemblance to President Clinton's Goals for Technological Literacy for the 21st Century:[1]

1. Provide access to modern computers for all teachers and students.
2. Connect every school in America to the Information Superhighway.
3. Develop effective software in all subject areas.
4. Give every teacher the development they need to help students use and learn through technology.

These goals, articulated in the President's 1996 State of the Union Address, like the Telecommunity initiative's goals, identify access, teacher development, and student learning outcomes as educational technology priorities. The Telecommunity initiative, however, attempts to narrow the often wide chasm between technology implementation and student outcomes by first aligning instructional goals with technology use.

The Telecommunity initiative is aligned with the Ohio SchoolNet, which provides an infusion of resources to build the technology infrastructure in Ohio. The Telecommunity initiative remains autonomous from the SchoolNet architecture by employing cutting-edge technology that seeks to provide students with greater access to real-life collaborative learning experiences.

Supporting the Telecommunity venture are nine major telephone companies in the state that have contributed $26 million to the effort. Schools are encouraged to connect and collaborate with businesses, institutes of higher education, and community resources. The combined efforts of the many partners involved in this initiative not only help schools and districts achieve their full potential as centers of learning, but also make the entire state of Ohio one large "telecommunity."

The Evaluation Report

This evaluation report is the second in a series addressing the development of the Ohio SchoolNet Telecommunity initiative. Overarching topics for evaluation inquiry include technology deployment, practices in professional development, and impacts of network use on students and teachers. The report is organized by 14 "most frequently asked questions," which are listed below:

- What criteria are generally used to identify successful distance education?
- Which projects are using distance learning technologies optimally?
- Are there common elements in project implementation?
- How do different models of distance education compare?
- Are the projects on track with regard to timelines, hardware acquisition, professional development, and content?
- Are projects migrating to higher standards?
- Were planning grants helpful in building a guiding coalition and building capacity for the work?
- What impacts on student learning is the Telecommunity project responsible for?
- What impacts on teachers and teaching is the Telecommunity initiative having?
- Are we developing assessment tools to assess student learning effectively?
- What does the professional development picture at Telecommunity implementation sites look like and is it sufficient?
- Is distance learning cost-effective in the Telecommunity sites?
- Is distance learning promoting equity within the Telecommunity sites?
- How are Telecommunity sites leveraging existing technology resources and what are the outcomes?

These questions were identified by the evaluation team and Telecommunity project development team members. By synthesizing and analyzing evaluation data, we

[1]President Clinton's State of the Union Address to Congress, January 23, 1996. Available at: http://www.whitehouse.gov/WH/New/other/challenge.html#education.

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constructed responses to these questions that hopefully provide a birds-eye view of the status of the project and the issues and challenges it confronts as it becomes a primary school change tool in the communities where it is implemented.

As a comparative resource, this evaluation report also profiles two other projects—OWLink in Houston, Texas, and the St. Louis (Missouri) School District—that are also using two-way, interactive communications technologies to improve student learning. While the profiles in no way represent the range of possibilities that exist for using the technology, they do illustrate the purposes, uses/nonuses, and outcomes for two specific applications.

This report is preceded by several smaller updates, reports, and briefings that have informed the project over the past year. These evaluation artifacts are listed in a larger technical report submitted to the SchoolNet Telecommunity project management team and Ameritech, Ohio—current funder of this evaluation. Also included in the technical report are a methodological overview, case studies, site visit summaries, survey data, and corresponding interview protocols and survey instruments.

Frequently Asked Questions

What criteria are generally used to identify successful distance education?

In a statement prepared for a conference of school principals, Samuel Sava,[2] the head of the National Association of Elementary School Principals, questions the way the nation is attempting to fill schools with computers. "I haven't the slightest doubt about the value of computers in our society. But I question whether we have learned to apply this technology to K–8 instruction." Like Mr. Sava, scores of parents, teachers, administrators, and legislators in districts throughout America wonder if and how educational technologies have improved student learning.

Addressing these questions begins with identifying what we value in terms of outcomes. In the case of distance learning technologies, several criteria are available, generally falling into one of four domains: technical, instructional, organizational, and ethical.[3] Technical criteria are those that concern equipment specifications and performance. Instructional criteria are concerned with the delivery and access of instruction and its outcomes for learners. Organizational criteria are those concerned with the day-to-day use of distance learning technology along with the support mechanisms and inservice training necessary to sustain its use. Ethical criteria address the availability of the technology to diverse learning audiences.

A person would be hard-pressed to locate an evaluation or study that rigorously incorporates all these criteria. Cost and the lack of availability of evaluation expertise severely limit the option of applying all criteria in a single context. Consequently, instructional criteria usually get the first and longest application by researchers, project developers, and decision makers. And, of all instructional variables, learner achievement and attitudes about learning are most frequently examined. In a broad generalization of studies that have investigated instructional outcomes for distance technologies, two conclusions are drawn:

1. Students taking courses via instructional distance learning achieve as well as students taking courses via traditional methods.
2. Distance learning technologies as devices for communicating instruction have no intrinsic motivational effect on student achievement.

These conclusions continue to be accurate with regard to the traditional application of distance learning technologies. They cannot, however, be applied to the Telecommunity initiative, which encourages a more interactive, collaborative, and innovative use of distance technologies. For evaluating a more intensive application of distance technologies like that used by the Telecommunity project, the technical, instructional, organizational, and ethical domains are still valid, but they must be applied in a way that is more sensitive to the new and varied outcomes the project seeks to achieve. Because of the multiple capabilities network-video has, multimedia research can also be drawn on as a resource. Multimedia research has a valuable history in applying interactive technologies, although as Foertsch[4] reports, the research produces mixed results, showing interactive technologies having a positive

[2] Henry, T. (1997, September 3). Educator questions computers' educational value. *USA Today, Tech Report.* Available at http://www.usatoday.com:80/life/cyber/tech/cta931.htm

[3] Hawkes, M. (1997). Criteria for evaluating school-based distance education programs. *National Association of Secondary School Principals Bulletin (80)*581, 4552.

[4] Foertsch, M. (1997). What effect does technology have on test scores. In M. B. Tinzmann (Ed.). *Technology and education.* Oak Brook, IL: North Central Regional Educational Laboratory.

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impact on achievement at some times and a negligible impact at others. The results tend to differ according to the specific type of technology used and how it is implemented.

Which projects are using distance learning technologies optimally?

Optimal use of the technology is widely defined among projects, yet what they share in common is the goal of transforming traditional classrooms into new learning environments.[5] Representatives of almost all the projects spoke of the need to avoid "talking heads." The inherent nature of teleconferencing, however, and basic design decisions that the projects have made influence the degree to which collaboration and interactivity is possible. Projects that have adopted a traditional distance learning approach are likely to have more difficulty in generating interaction than those that have decided to use teleconferencing to provide resources not available by other means. Two examples of these differing approaches are the Columbiana and ImagiNet projects.

Columbiana is using distance learning in the traditional way to expand the number of courses available to the high schools in its Telecommunity. Courses originate in one of the high schools and are received at remote sites. The teachers use a variety of methods to encourage students to interact with them and with other students across sites. These include sending "hands-on" materials prior to classes, asking questions of students at remote sites, and directing students to interact across sites.

ImagiNet has based its project on a different approach. It is assembling a variety of resources that can be included in different courses at different grade levels. For example, one curriculum unit on the table proposes to engage fourth-grade students in the study of electricity by integrating the subject with mathematics and reading. In this series of four 30-45 minute teleconference sessions, students will work hands-on with electricity materials while studying science, mathematics, and reading. The unit meets Ohio's Proficiency Outcomes by covering topics on energy transformation, electricity, and problem solving. In two separate after-school sessions, the facilitators will work with teachers to continue to transition and integrate activities seamlessly (one session prior to the student teleconference and one after the student teleconference sessions).[6] The project is informing teachers in its Telecommunity about this and other resources and will schedule the presentation of the resources at times mutually agreed upon by the teachers and the presenters. In identifying the resources to be offered, ImagiNet has emphasized materials that can be shown on television and opportunities for students to talk with those who present the materials.

By the prevailing criteria, ImagiNet's design appears to have the potential to come closer than Columbiana's to achieving optimal use of teleconferencing. When ImagiNet and similar projects are operational, they should be studied to see if their students are more active and self-directed in the use of teleconferencing resources than are the students in traditional distance education classrooms.

Are there common elements in project implementation?

To address this question, the implementation projects informing this study are contrasted on two dimensions in Table 1 (see page 4): delivery platforms and levels of implementation.

Strong central leadership is a must in distance learning implementation. This tenet poses an interesting dilemma—strong central leadership often results in the "If we build it, they will come" model, an approach with clearly unpredictable consequences. The alternative, namely a more democratic approach involving teachers and students in the decision-making process from the beginning, is both time-consuming and labor intensive. Examples of both can be seen in the Telecommunity sites visited for this evaluation.

The two Telecommunity sites fully or nearly fully operating have much in common, with the former serving as a model for the latter. Columbiana County and NOTA both have strong central leaders who made the decisions necessary to build traditional room-based distance learning systems and got on with the task as quickly as possible. Not surprisingly, they have the most to show for their efforts at this point. (It should be noted that Columbiana County was operational several years before Telecommunity money became available, and NOTA started their move to distance learning before funding was available as well.) It should also be noted that traditional distance learning has been

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[5] *National educational technology standards: guiding the development of new learning environments for today's classrooms.* Paper presented at TeleED 1997, Conference of the International Society for Technology in Education, Austin, TX, November 15, 1997.

[6] Further information on ImagiNET curricular planning and development available at http://www.nwoca.ohio.gov/www/inet/nethome.html

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Table 1
Project Implementation Status

	Traditional Distance Education	Full-Motion Portable Units	Desktop Video
Operating	• Columbiana • Northern Ohio Technology Association (NOTA)		
Almost Fully Operational		• ImagiNet • Indian Valley • New Lexington • Tiffin	• Catholic Conference • Summit County
Equipment Purchased, Dealing With Installation/ Networking Problems		• Learning Community Link	
Equipment Not Yet Purchased		• Hospital, Educators, Arts, Link (HEAL) • Upper Arlington	

around a long time. And while technological advances such as digital video continue to influence purchasing decisions, equipment selection for room-based systems is much more straightforward than it is for the more flexible and portable technologies.

Implementation in both of these consortia involves recruiting teachers and selecting courses, determining which sites will carry which courses, arranging schedules, organizing special events and professional development activities, and so on. Both systems have selected hardware that promotes teacher-centered instruction, though the directors of both are aware of the need to engage students actively in the learning enterprise. Both feel very positive about their implementation to date and anticipate growth in the coming years.

Commonalities in sites selecting more portable distance learning and/or Web-based technologies are not as detectable, partly because these sites are not very far along in implementation. Evaluators did notice a common attempt to provide interactive resources not available through other means. A statewide catalog of resources was mentioned often as the kind of assistance these sites would most like to receive from the Telecommunity office. Museums; zoos; and science, history, and language facilities are among the content providers already tapped by Telecommunity projects. Another common theme among these sites is the deliberate attempt to develop student-centered applications and avoid "talking heads."

It should be noted that although they may share certain characteristics, each project is unique and each is trying to preserve and strengthen that uniqueness by the types of activities they select for videoconferencing. This brings up the question of whether the catalog of resources requested above would tend to reduce the need and impetus to find original applications for distance learning. We have already noted a tendency to gravitate to The Ohio Historical Society, whose staff has been very generous with their time and produced valuable learning experiences. It would seem that the value of a resource such as this would outweigh the potential drawbacks, although Telecommunity sites should be requested to add new entries from time to time. In addition, some attention may need to be given to the drain on resources of the more popular sites listed.

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How do different models of distance education compare?

This is a difficult question to answer because the variables are so numerous. Fluctuating hardware costs, negotiable line fees, and so on make the measurable costs difficult to pinpoint, to say nothing of the intangible aspects of learning experiences and goals that can be very different from system to system. Generally speaking, traditional room-based distance learning is more expensive to install and to use than Internet-based distance learning models. The difficulty at the present time is that only beta-test versions of full-motion video in desktop format are available. Full-motion desktop video is not yet a standard application. This has made equipment decision making extremely difficult for Telecommunity projects, as the case studies indicate, and has caused some hesitations and delays in purchasing decisions.

As a result of this year-two evaluation, we strongly suggest that the focus shift from hardware-based models to the curriculum and instructional needs of a given project. If a district or consortium has identified as its primary need the sharing of courses in a distance learning network, traditional two-way, full-motion video is called for. If a district or consortium has determined that student-centered, experimental, and/or wide network applications within all courses are more appropriate, then they will chose desktop video technology. In either case, we recommend easy access to the Internet as a standard function since this seems to be the direction of the future of telecommunications. Flexibility is key to whatever system is employed. A rule of thumb for many years for computer purchases has been to buy systems that can be easily adapted. Our recommendation to the Telecommunity grantees of the future: Chose a system that allows you to meet your present curriculum needs and is at the same time flexible and adaptable to accommodate emerging applications and communication patterns. Unfortunately, this is easier said than done.

We recommend that the Telecommunity office publish guidelines, based on its vantage point with vendors and applications insight, that would assist grantees in making decisions. These guidelines would include a list of the systems available for purchase, the types of curriculum and instructional needs these systems can accommodate, the current costs (both capital and ongoing) of the systems, and flexibility and add-on capabilities. As more sites make their decisions and become operational, they should serve as models for those just getting started. Once enough sites are operational, a comparative study can be conducted, not unlike that prepared for the U.S. Department of Education by the Rand Corporation in 1996.[7] This study compares the costs of eight school-based technology programs. As might be expected, costs varied from $152,000 per year to $381,000. Differences in computer densities and in support personnel seemed to account for most of the variance.

Are the projects on track with regard to timelines, hardware acquisition, professional development, and content?

At the end of 1997, only one project, Columbiana, was fully operational (see Table 1). The other projects varied along a continuum from NOTA, which was operating but at less than capacity, to Summit County and Upper Arlington, which had not acquired any equipment or conducted any professional development. Most projects were delaying professional development until they had equipment installed that the teachers could use. HEAL and LCL used funds from other sources to conduct summer workshops for their teachers and to support the development of content. New Lexington and Tiffin have been working closely with The Ohio Historical Society to develop content. ImagiNet has been assembling a variety of resources that teachers can use as appropriate to their classes.

The projects that are not yet operational have been dealing with a variety of problems that have put them several months behind their original schedules. Most of these problems relate to the purchase and installation of equipment. Purchasing decisions have been the most difficult, partly because an attempt by the Telecommunity office to organize a bulk purchase of network-video hardware stalled when the plan hit the lengthy and tedious review process required by the Ohio State Department of Administrative Services (DAS).

Are projects migrating to higher standards?

Most projects are too early in their implementation to make any judgments about the effects of teleconferencing on higher standards with regard to student performance. The exception, once again, is Columbiana,

[7] Keltner, B., & Ross, R. (1996). *The cost of school-based educational technology programs.* Boston, MA: Rand Corporation. MR-634.0-0STP/DcED.

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which has been operating for several years. In this Telecommunity, teachers report that there is some tendency among the students at the separate high schools receiving the same course to try to represent their schools well. The teachers also note that when the best students in the separate schools take distance learning courses, they sometimes find that there are students as bright or brighter than they are at other schools.

Among the teachers returning questionnaires who have used network-video technology, almost three-quarters (47) answered questions about its impact on student performance. Sixty percent of these teachers thought that the technology helped their students "do higher quality work and produce higher quality products."

Higher standards can also refer to what is expected of the technology. Here it is clear that the projects want high-quality transmission, ease of use, and flexibility. Because the technology is changing so rapidly, some projects have been reluctant to make any decisions for fear that a much better product will become available in the near future.

Were planning grants helpful in building a guiding coalition and building capacity for the work?

Planning grants provide the opportunity for thoughtful consideration of how technology can best be used to enhance learning. In the absence of planning grants, this issue can be given scant attention or ignored entirely as decisions about equipment become the primary focus. Even with this opportunity, however, there is little evidence that the projects that received planning grants were more successful in fostering a shared vision of the best ways to use the technology or in building capacity. This may be because planning grants tend to be associated more with ambitious projects and different types of partners and more money requested than are the average projects. Because of their complexity, however, such projects tend to be more difficult to implement and to take longer to become operational than do projects that do not receive planning grants.

Planning grants may also tend to raise expectations. Complaints about the difference between the funding requested and the amount received were more common from projects that had received planning grants. When representatives of projects that received planning grants were asked why they thought they had received less than they had asked for, they indicated that they requested only what they thought they needed to do the job. As a result, many consortia were left with the difficult task of reworking curriculum and professional development activities based on available funding.

The planning process could be improved by providing more structure and clearer parameters of what will and will not be funded. Workshops for grant recipients are reported to be helpful. Perhaps the greatest planning resource prospective Telecommunities have comes in the form of Telecommunity faculty, whose assistance is reported as facilitative. Because faculty members have only six months' experience in the Telecommunity project, expectations for widespread results in planning are unfair.

Fifty-nine of the teachers who returned questionnaires had used network-video technology. These teachers were primarily from projects that had not received planning grants. They were about equally divided on whether they were "extensively involved in the planning stages of the Telecommunity project development." Slightly over half (54%) agreed or strongly agreed with the statement and the rest disagreed or strongly disagreed. These teachers, however, were far more likely to agree (80%) that they are "able to provide input on the ongoing development of the Telecommunity project that project leaders hear and respect."

How does the Telecommunities project affect student learning?

In attempting to understand the outcomes of an innovative educational technology project such as the Telecommunity initiative, the evaluation team has attempted to focus most heavily on instructional and organizational criteria. Other criteria, such as technical aspects of project development (e.g., transmission speed, system interoperability and flexibility), are closely monitored by Telecommunity staff. And, by virtue of the Telecommunity's policy to give low-wealth schools funding priority, ethical criteria seem met on a project-by-project basis, although there is some evidence that some implementation sites have only made the technology available to upper-level and/or high-performing students.

To date, the evaluation has avoided any comparison of student scores on standardized tests. The reason for

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this is simple: The technology has not been in place long enough (if at all) to expect outcomes in achievement that are a result of network-video use. Not until the technology is in place and is used on a systematic basis will attempts to assess student learning be useful enough to base policy decisions on or to guide Telecommunity development.

What this evaluation has collected so far in terms of student outcomes is information on student behavior and performance. These outcomes illustrate the richness of learning that some educators suggest even standardized scores cannot capture. This information, gleaned from case studies and site visits, comes from students like New Lexington's fourth graders who, according to their teacher, apply themselves in content learning for longer periods of time, show stronger interest in learning activities, and show improved classroom behavior.

Teachers in other implementation projects note that access to other students breaks down communication barriers and inaccurately held perceptions about students in other parts of the state or with diverse backgrounds. Teachers also indicate that network-video contact with students in other schools is a strong motivational force that incorporates the element of competition. Not wanting to be "shown up" or "embarrassed" in front of their online peers, the quality of student work is reported to have improved while assignment due dates are observed more carefully.

To roughly quantify the types of impacts that network-video use is having on students, evaluators identified 16 separate outcomes in three categories. Teachers completing the Telecommunity implementation survey indicated which impacts they had observed in a substantial number of their students. The results are shown in Table 2.

Predictably, the most noticeable effects of network-video use in terms of student performance are access to a wider base of information (92%) and to current information (92%). Three-quarters of the teachers note that their students are better able to evaluate the expertise of information (75%), and 60 percent of the teachers attribute higher-quality work and products to network-video usage.

Table 2
Teacher-Perceived Impacts on Student Learning

	Percent
Improvements in Student Performance	
Students have greater access to current information.	92
Students have access to a wider base of information.	92
Students take more interest in world events and foreign cultures and societies.	81
Students learn to evaluate the expertise/authenticity of information to make more informed decisions.	75
Students have a deeper understanding of the ideas they encounter.	64
Students do higher-quality work and produce higher-quality products.	60
"Average" kids are communicating and producing in ways only "gifted" kids did before.	53
Students have more interest in understanding the "adult" world.	49
Students are more able to communicate with adults they do not know personally.	47
Motivational Effects	
Students take on more responsibility for their own learning.	87
Students apply themselves for longer periods of time.	81
There is a sense of heightened self-esteem in students.	79
There is improved student behavior.	75
Changes in Student and Teacher Roles	
Students are better at working collaboratively with peers.	96
Students show greater ability to regulate their own learning.	77
Student expertise is more equally distributed—less concentrated in a few "high ability" students.	60

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A good deal of research is available linking student motivation to improved achievement. Perhaps that's why the high percentage of teachers indicating that network-video usage is responsible for increased student motivation is so encouraging. Here, large majorities of teachers agree that students take more responsibility for their own learning (87%), apply themselves for longer periods of time (81%), have higher self-esteem (79%), and show improved classroom behavior (75%) as a result of network-video use experiences. Teachers are also attributing greater student collaborative ability (96%) and self-regulatory ability (77%) to network-video usage.

These results are encouraging. However, it should be noted that only 44 teachers were familiar enough with the outcomes of network technology use to be able to respond to the survey item. From a potential respondent base of several hundred teachers in 11 implementation sites funded for a year or more, that number is quite low. While the problem speaks more about the difficulties of getting the technology into the classroom than it does about its actual use, it is far too little information and far too early in project implementation to be unequivocal about network-video instructional value.

Even where network distance learning systems are installed and operative, there are negative reactions to its use. Instances of technology use documented in case study and site visit reports shows that some students prefer "regular" classrooms because of incompatible bell schedules between connecting schools, technical glitches, and "other distractions." It should be noted that these concerns came almost exclusively from students in Telecommunities where the technology is being used in a traditional distance learning way, that is, when the technology is used to broaden course alternatives in a school's curricula rather than to support and supplement instructional activities.

What impacts on teachers and teaching is the Telecommunity initiative having?

Teacher interviews and hours of observation make one point clear for a majority of teachers in the Telecommunity initiative: The application of the telecommunications technology in the classroom completely turns their current beliefs about teaching on its ear. Many teachers make a relatively smooth transition. Yet for many others, the amount of change required in both outlook and practice is significant, as the comment by this teacher illustrates:

> *I think I'm still sometimes more of a traditional teacher than I should be. Sometimes learning in my classroom, especially the first year, is more teacher centered than it should be. . . . I'm not all that uncomfortable with the technology anymore. . . . I just realized that all of their [students'] futures lie in that direction, so I did my best to come along.*

As much as the Telecommunity initiative is about changing the way students learn, it is also about changing the way teachers teach. To determine in what ways network-video usage might be changing the way teachers perform their professional activities, we identified a number of teacher tasks and asked teachers to respond on a four-point scale how significantly network-video use increases their ability to perform these tasks. The results are recorded in Figure 1.

Increases in teachers' ability to perform professional activities are reported to range from marginal to moderate. All of the activities indicated an increase in the teachers' ability to perform them. Some interesting outcomes teachers say are a result of network-video use include the increase in ability to integrate curriculum with state frameworks (2.75). Teaching activities that are collaborative in nature—such as working collaboratively with colleagues (3.07), supporting student-centered learning (3.16), and interdisciplinary teaching (3.11)—also received high marks.

Network-video technologies are reportedly least able to increase teachers' ability to assess student progress (2.26) and save on preparation time (1.90). Preparing for network-video use appears to consume large amounts of teacher preparation time. This is not unexpected for a new and emerging technology.

What do teachers need to integrate network-video technology more effectively?

1. Professional development that is more technology-integration oriented (discussed later)
2. A vision (models) illustrating what is possible with network technologies
3. Time to adapt to the technology

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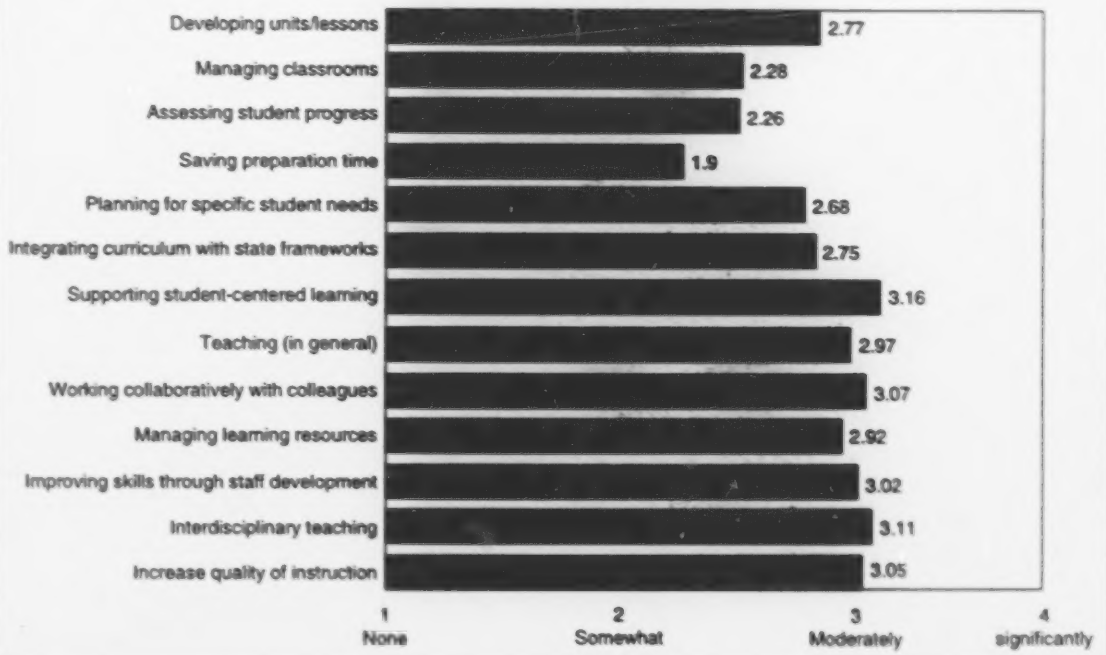
Figure 1

Teacher Perceptions of Network Video Technology's Ability to Assist in Professional Tasks



Are we developing assessment tools to assess student learning effectively?

Educational technologies have proven very capable of assessing student products and processes in a variety of ways. For teachers in various Telecommunity projects throughout the state though, assessment is still dominated by standardized paper-and-pencil testing.

This evaluation observes that it is because of the pressure for satisfactory performance on existing assessments that new practices are slow in evolving. Teachers' dissatisfaction with current forms of assessment often find them wondering how they can use the technology to improve assessment strategies. Yet, the pressure to test well often impedes teachers from experimenting with new assessment forms. The point is illustrated by a fourth-grade teacher in Tiffin City who shares her thoughts about mediating the pressures of performing well on the proficiency exam with her interest in using interactive technologies:

> *With the test in March, once Christmas is over our nose is to the grindstone. I want our students to do well on the exam. I'm glad I can incorporate the technology because it provides instructional variety. But sometimes I guess I'm so driven by the test that lots of times I feel I have to do other things [other than experiment with technology applications].*

Of the limited number of curricular units that have been developed for network-video delivery across the Telecommunity initiative, few give any indication that assessment was considered in the planning of instructional goals and technology use. This is not unusual and, in fact, might be quite expected given the rush and pressure that some programs worked under to get network-video systems up and running in their schools. Failure to align assessment with instructional and technology goals can be detrimental. Such was the case in a study by Means and Olsen,[8] where standardized measures on student achievement were not compatible with the technology-supported instruction being devel-

[8]Means, B., & Olsen, K. (1993). Tomorrow's schools: Technology and reform in partnership. In B. Means (Ed.), *Technology and education reform* (pp. 191-222). San Francisco, CA: Jossey-Bass Publishers.

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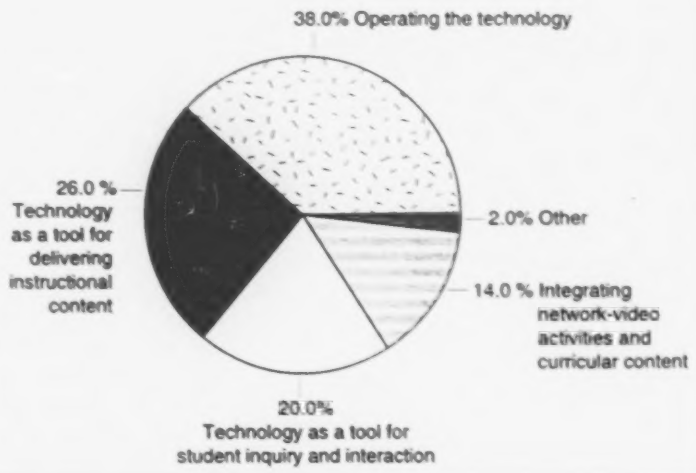
oped. The mismatch between the assessment tool and the technology goals led decision makers to believe that outcomes in student achievement could not be attributed to the technology integration project, which subsequently led to the projects demise.

To be sure, there are instances where network-video technology is used not only to engage students in meaningful learning activities but to assess them on that learning as well. A few teachers are using software tools to store electronic audio clips of their students' foreign language skills. Interactive multimedia formats help teachers keep portfolios of student work, and video and audiotape footage helps teachers assess student presentation skills. Instances of technology use for assessment, however, are too few and far between. More time, thought, and experimentation need to be given to assess not only skills-based outcomes, but higher-order thinking outcomes as well. Here is a place where broad-based intervention by the Telecommunity office to identify exemplary assessment practices using the technology and disseminating those practices would be valuable to project sites.

Figure 2

Types of Telecommunity Professional Development Activities


38.0% Operating the technology
26.0 % Technology as a tool for delivering instructional content
2.0% Other
14.0 % Integrating network-video activities and curricular content
20.0% Technology as a tool for student inquiry and interaction

What does the professional development picture at Telecommunity implementation sites look like and is it sufficient?

As described by teachers in Telecommunity implementation sites, the professional development they receive is generally workshop based and focused on operating the technology. In Figure 2, the emphasis on various types of development activities is illustrated. Teachers' overall assessment of their professional development on a four-point scale, ranging from poor to excellent, is average at best, as Figure 3 illustrates.

Case studies also illustrate where current forms of professional development have done little to build teachers' capacity to integrate and deliver network-video-supported instruction. These professional development events often take the form of a single workshop or short series of workshops placing teachers in the roles of passive consumers of knowledge produced elsewhere. Training of this type is characterized by the delivery of fairly generic ideas disconnected from the realities of classroom practice. Words from one participant in training delivered this way are revealing:

> *Some of the technology they were using was old technology. The training was prepackaged. It's something they've probably done for many years. Nothing they did catered to teachers' working with the children and doing interactive things. That's what we expected.*

Quite different from the types of professional development activities described above are development activities that are more collaborative, participative, and, consequently, productive. These too are described in the case studies and are characterized by their emphasis on codevelopment and collegiality.

One example of development of this type is the Catholic Conference's Tuesday morning desktop video-facilitated meetings where lead project participants at each of seven high schools in the state meet to problem solve, generate ideas, and share successful strategies and resources.

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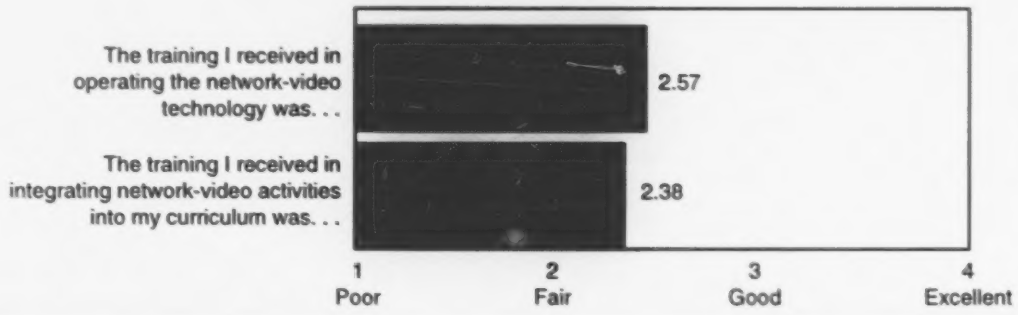
Figure 3

Rating Professional Development Activities


The training I received in operating the network-video technology was. . .
2.57
The training I received in integrating network-video activities into my curriculum was. . .
2.38
1 Poor
2 Fair
3 Good
4 Excellent

New Lexington's Judy Cannon, a fourth-grade teacher, describes another process of productive professional development that primarily used electronic communications systems. Judy engaged in a combination of reciprocating e-mail and live network-video dialogue with Sean Pickard of The Ohio Historical Society to identify instructional goals, set presentation and activity parameters, and explore the possibilities of using artifacts in collaboratively developing an integrated unit on Ohio history. Judy describes this experience of collaboration as "my best training."

K-12 education reform research suggests that new models of teacher professional development are needed to establish and support communities of teachers engaged in school improvement and educational technology use. Yet little training offered to teachers in current Telecommunity implementation sites does just that. In fact, teachers report that the types of development activities that are collaborative, collegial, and built on the shared expertise of their peers constitutes only a small percentage of the total development that is offered (see Figure 4).

The importance of professional development cannot be underestimated in this project. A recent article by Moersch[9] underscores this point. He revealed that three out of the four top reasons for technologies meager performance in schools is directly related to teacher training deficiencies.

This evaluation finds that professional development in Telecommunity implementation sites may be intensive, but perhaps not always focused on the right areas. To apply network technologies effectively in the learning and teaching process, professional development needs to be integration oriented. The processes that guide professional development must also be participative and collaborative. Finally, there is some evidence to suggest that the audience (teachers) for current professional development activities is too narrow and should involve participants from museums, higher education, and other partners so that systemic development in network-video use in schools occurs.

Is distance learning cost-effective in the Telecommunity sites?

If distance learning were a replacement technology, the answer to this question would be easy to calculate. However, the implementation of distance learning technology allows a school system to achieve educational goals not possible or practical without it. This makes it inappropriate to apply typical cost-effectiveness formulas that assume a comparison with traditional education. Three factors must be considered in determining the cost-effectiveness of distance learning in a Telecommunity project: (1) actual costs associated with installing and maintaining the system, (2) the educational importance of the applications made possible by the system, and (3) the effectiveness of the system in terms of expected learning outcomes. Furthermore, this year-two evaluation has revealed that Telecommunity grant recipients need at least three years to become fully operational. Obviously a system must be in the full-implementation phase before valid cost-effectiveness data can be collected.

In view of the above, the evaluation team proposes that the Telecommunity adopt a plan for determining cost-effectiveness during the fourth or fifth year of a project's history. The procedures that follow provide

[9]Moersch, C. (1997). Computer efficiency: Measuring the instructional uses of technology. *Learning and Leading With Technology (25)4*, 100-106.

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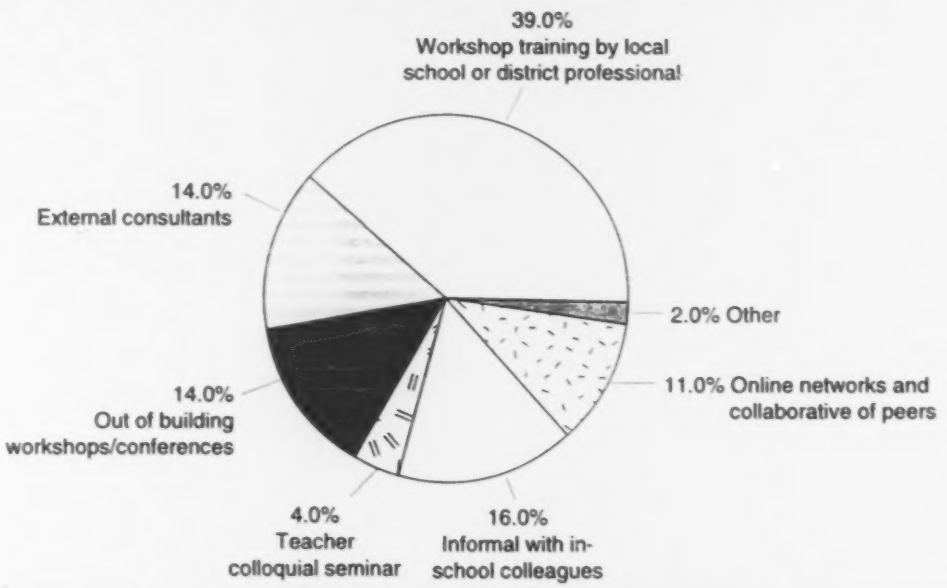
Figure 4

Delivery Formats of Telecommunity Professional Development Activities



two alternatives that may serve as the basis for individual adaptations. We present them with the caveat that we would not want cost-effectiveness concerns to distract the Telecommunity from the more important issues of achieving full-scale implementation and assessing subsequent outcomes.

A Quantitative Approach. For those who are convinced by numbers, the following steps or some variation thereof would produce a quantitative cost-effectiveness analysis:

Step 1: An evaluator polls all partners and primary stakeholders to determine the five most important uses of the system during that year; e.g., communication between students of different school districts and social backgrounds, specific course offerings that were not available before, conversations with a NASA astronaut, and so on. Those polled also provide a rating of the importance of each activity for the overall educational goals of the district.

Step 2: Project managers calculate the real costs of running the system for a year, including monthly line fees and personnel costs, and capital investments amortized over a five-year period.

Step 3: The project manager then estimates the cost of accomplishing these applications without distance learning technology, thereby producing a "virtual costs" figure. This component is the most difficult (some would argue impossible) to calculate. If the real costs calculated in Step 1 are lower than the "virtual costs," the site has achieved one aspect of cost-effectiveness.

Step 4: An evaluator and the project manager agree on effectiveness criteria based on the nature of the five applications selected, and on the methods for assessing whether these criteria have been met. Methods may range from Likert-type questionnaires administered to students and teachers to assess perceived learning effectiveness, to an examination of test scores.

Step 5: Merging importance ratings collected in Step 1 with effectiveness data collected in Step 4, evaluators determine if the Telecommunity site has achieved cost-effectiveness based on predetermined criterion levels.

A Qualitative Approach. Some may prefer a more ethnographic approach to determining the cost-effec-

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tiveness of distance learning systems. This approach involves detailed documents analyses, surveys, observations, and interviews with students, parents, teachers, facilitators, and principals and other top educational administrators and decision makers. After careful examination of all aspects of the project, the evaluator makes an informed judgment about cost- effectiveness. Ethnographic evaluations are more time-consuming and expensive but provide a more comprehensive picture.

Is distance learning promoting equity within the Telecommunity sites?

The answer to this question is yes and no, qualified by the reiteration that very few sites are fully functional at the time of this writing.

Expanding Course Offerings. Consortia such as Columbiana and NOTA are making courses available to districts described as "very high poverty, high poverty, low poverty, or blue collar." These are courses that these districts would otherwise not be able to make available to their students. Insofar as they are meeting the needs of these students, these consortia are promoting equity within their respective Telecommunity projects. They are deservedly proud and pleased about this accomplishment and value it as a component of their respective projects. As with the cost-effectiveness question, the adequacy of a site's or consortium's attention to equity can be quantified if the stakeholders so desire by calculating the number of low-income students within the geographical area compared to the number actually being served by the Telecommunity grant.

Cross-District Interactions. One aspect of equity that is addressed by some Telecommunity projects is the promotion of interactions across districts—in some cases blue collar districts and more affluent districts—that would otherwise not provide opportunities for students to interact. The NOTA case study provides anecdotal evidence that positive social and academic exchanges between students of different socioeconomic backgrounds can be a very important result of distance learning. Other sites—including Columbiana County, Tiffin City, and New Lexington—are also engaging students in interactions to promote understanding and tolerance. One of the major objectives of the Upper Arlington project is to engage its homogeneous, upper-middle-class students in dialog with students from different socioeconomic/ethnic backgrounds. These efforts—made possible only through the technology—could serve as models for projects just getting started.

Expanding Learning Opportunities. Several of the projects that are not yet operational have the goal of exposing their students to new opportunities. The LCL and Indian River projects, for example, serve several rural districts with large federal government-defined poverty populations. The students of these districts rarely travel from these areas, much less visit museums, science and technology centers, zoos, and so on. The directors of these projects hope that teleconferencing will expose their students to such facilities. The HEAL project has the same goal for the inner-city students that it serves.

Dropouts. This evaluation uncovered a potentially serious problem in the area of equity—a problem that must be addressed by the granting process in the coming years if equity is to be held up as an important goal. There have been numerous instances during consortium formation where districts either fail to "sign on" or feel the need to drop out after hearing the costs of participation. While we do not have "hard data" about how many low-wealth districts have had to back down, we have sufficient evidence from project administrators to confirm that this is a potentially significant problem within the Telecommunity. Several steps need to be taken for low-wealth school districts to have an equal chance at participation in Telecommunity projects: (1) more of the initial equipment investment needs to be picked up in grants and (2) ongoing line costs and maintenance expenses need to be contributed or greatly reduced.

Wealthier districts are also withdrawing because they feel they contribute more to the Telecommunity than they receive. The more affluent districts typically offer more regular courses and sometimes originate more distance learning courses than they receive. The directors of a few projects have reported that this situation has caused some districts to discontinue their participation.

Equal Access. Access is another equity issue uncovered by this evaluation. Some projects provide use of the system by grade level or content proficiency. For example, the Catholic Conference lets third- and fourth-year language class students use the telecommunications equipment the most. The project is working furiously to get second-year students on as quickly as

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possible, but some skill prerequisites seem to be required to use the technology productively. In other instances, the technology is used for upper-level or AP course delivery for the majority of the time. In at least two sites, teachers stated that they encouraged the "more capable" or "more motivated" students to participate in distance learning courses, at least at this early stage.

On a related but somewhat different note, evaluators observed a rather disturbing scene during one site visit in which unpacked boxes of distance learning equipment were stacked next to buckets collecting rainwater dripping from a leaky school roof. This image is recalled here simply to illustrate how complicated and difficult the equity issue is. In some instances, basic building maintenance needs must be attended to before wiring and sophisticated electronics can be safely deployed.

How are Telecommunity sites leveraging existing technology resources and what are the outcomes?

Six of the 11 implementation sites have leveraged their Telecommunity equipment and participation to align with new partners; expand the array of applications for the technology; and/or bring local, state, or federal funds into schools. Here are some examples:

- The "Why is Rush Creek Orange Project?" written by The Ohio Historical Society and funded by the Ohio Environmental Education Fund is exclusive to students in New Lexington at grades 1, 3, 5, 7, 9, and 10. This problem-based learning project provides network-supported, collaborative planning time and money for curriculum materials to study the very polluted Rush Creek in Perry County. New Lexington's interactive network-video capabilities are reported as a key ingredient in making this project happen.
- At St. Johns High School in Bellaire, local television broadcasting affiliate WGRS sponsors weather department "out stations." St. Johns, part of the Catholic Conference Telecommunity, is currently applying to become one of those stations. If accepted, the school will receive several pieces of meteorological equipment students will use to monitor weather patterns and conduct experiments. With the desktop video, the school will also gain some content expertise (station meteorologists) and use the live video capability to report weather observations. School administrators and teachers expect that St. Johns is likely to be accepted as a part of that meteorological program because of the telecommunications technology already in place.
- NOTA is calling upon the expertise at WVIZ-TV in Cleveland to provide courses to prepare students for the SAT and ACT exams. They are also working with the Lewis Research Center, a NASA facility, to provide "specials" on aerodynamics and other related topics. These presentations feature one hour of background lecture and demonstration by the scientist and one hour of hands-on interactivity, with related computer software provided free to participating districts.
- The HEAL project used Urban Initiative funds from the National Science Foundation to provide a two-week summer workshop for teachers in the Telecommunity project from the Cleveland Public Schools. The Cleveland Museum of Art, one of the Telecommunity partners, received funds from the Ameritech Foundation, separate from the Telecommunity grant, to develop curriculum for the project. The Cleveland Metroparks Zoo, another partner, used state funding for educational outreach to provide materials and facilities for the summer workshop and to develop curriculum.

As technology becomes available to the Telecommunity sites, their ability to create new learning opportunities will be limited only by the time necessary to articulate how network resources might be used and the availability of information announcing partnership and funding opportunities.

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Project OWLink

Description

The goal of the OWLink project is to experiment in innovative ways with the combined use of videoconferencing and Internet technologies in the K-12 setting. Two high schools and a single middle school in Houston are involved in the project, as are two high schools in the Rio Grande Valley. Through an "electronic studio" concept, students and teachers, linked together by a telecommunication network, can work simultaneously to share notes, assignments, documents, images, video, and sound. Teams of teachers have developed curricular activities on the system that have included collaborative writing projects, online logic puzzle contests, and predictive analysis using biomedical data.

Project Support and Funding

The Center for Technology and Learning at Rice University manages the project and assumes most of the responsibilities for formal teacher training. Southwestern Bell funds workstations, file servers, peripherals, and other related classroom equipment and wiring. Houston and South Texas Independent School Districts provide schools, volunteers teachers, and rooms for the Electronic Studios.

Origin

The OWLink project began in June 1994 when the Electronic Studio program on the Rice campus was expanded to K-12 institutions. Behind the development of an "enhanced type of distance learning" was the belief that student work traditionally done in isolation needed to be done more collaboratively. Project developers also sought to reduce the dependence on textbooks as the primary means of delivering curricula and to offer students more opportunities to interact with experts and peers in other environments. OWLink is currently entering its third and last funding cycle carrying it through July 1998.

System Components

Each site has a room-based video teleconferencing system (two-way, full-motion) with two roll-about units. Ten Internet-accessible multimedia computers are tied to the local area network and connected to a server on which student notebooks, software, and other materials are stored. The Houston sites are interconnected via an ATM-based fiber-optic network, and the participants in the Rio Grande Valley are connected via copper T1 wiring.

Teacher Development

Each summer, new participating teachers attend a two-week training program that focuses on educating students using the technology. The training encourages integrated, interdisciplinary application of the technology. Teachers involved in the project are expected to train their colleagues and share their insights with a broad range of audiences. Teachers are encouraged to move at a comfortable pace. As one teacher indicated, "We don't feel like we have to come up with something that rocks the education world."

Unique Attributes

This project is characterized by a high degree of technical and pedagogical support, as well as an emphasis on collaboration. Rice University provides technical aspects of support on a day-to-day basis, e.g., router management, software installation, and connectivity oversight. After initial participation in the summer training session, teachers are expected to build their skills for applying the technology through practice. To assist that practice, collegial collaboration is both encouraged and planned. The development of curricular activities is frequently done between teachers on e-mail and using the network-video system. Recently, all teacher participants underwent training on synchronous, text-based software that allows multiple participants to simultaneously work and communicate together.

Impact

Little has been done to systematically assess achievement impacts of the distributed learning system on students. To date, evaluation has focused on teachers' comfort levels with using the technology and students' attitudes towards the use of technology. Teacher comments, documented through interview and focus groups, indicate that students are more excited and motivated about learning. Teachers also report being more invigorated about teaching; greater degrees of collaboration have been achieved as a network-connected community. One study conducted by Rice University on Princeton Review training shows that a Scholastic Aptitude Test review on the network for college-bound seniors produces equivalent results when compared to a "live" test review. Only now, in the fourth year, are project personnel attempting to determine what systematic outcomes on student learning have been achieved.

Contacts

Siva Kumari, Donna McKever, Rice University; David Truitt, Rice University K8 School

Web site: http://criceinfo.rice.edu/armadillo/Owlink

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St. Louis School District

Description

Four urban St. Louis School District high schools have dedicated room space for interactive video-network systems that deliver instructional courses that couldn't otherwise be offered to students. The network-video technology was chosen because it best replicates the condition of the traditional classroom where live instruction takes place.

Project Support and Funding

Project support began in the 1995-96 school year when state technology funds were used to equip the first two high schools in the program. Remaining systems were acquired through district technology-budgeted funds and other small technology grants. The regional education service agency provides technical systems support, and College of Education staff at the University of Missouri, St. Louis, assist in project management. Southwestern bell has also provided intensive technical and developmental consultation.

System Components

Each classroom contains three cameras: an automated teacher tracking camera, a student camera, and a document camera with 52" and 27" monitors in the front of the room and two 27" monitors in the back (V-Tel). Twelve desks (two students per desk) each have a "touch to talk" microphone and are fronted by a teacher control station with control pad. Schools are interconnected via SLPS video bridge. A dedicated T1 line offers compressed digital video (512 kbps, 30 frames/second).

Teacher Development

A three-day session is held in the summer to orient the teachers on the use of the equipment. The objective is to make help teachers feel comfortable in using the full range of system features. Teachers' skills are refined through continued use of the system.

Unique Attributes

Remote classrooms are staffed by noncertified content area teachers or aides. In the system's third year of operation, six courses are taught, reaching approximately 130 students. All courses are for "advanced students" and are ones that would otherwise not be offered in participating schools.

Recently, the system has supported brown bag lunch meetings for teachers at participating schools. According to the project director, "These meetings are intended to bring teachers together to collaboratively problem solve and share ideas."

Impact

Informally gathered qualitative information from teachers finds them agreeing that extensive planning time is necessary to repurpose and deliver a course on the system. Finding teaching and administrative support at schools, determining the proper amounts and focus of teacher training, and coordinating bell schedules are significant problems that the project has addressed. Project participants agree that the system is "not for every teacher or student." One teacher indicates, "Distance learning is successful as long as the teacher has charisma and the students are highly motivated."

Contacts

Phil Brody, Director of Technology, St. Louis School District; Donald Bright, Math Teacher, Vashon High School, St. Louis, Missouri

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Summary and Recommendations

This year-two evaluation was commissioned to look at the Ohio Telecommunity under the framework of three major headings: technology deployment, professional development, and student impact. We have provided case studies, implementation reports, and a survey of teachers that cover these categories and much more. Below is a summary of what we have learned in each of the three major categories and suggestions for enhancing the Telecommunity efforts in years to come.

Deployment

The first and most obvious finding is that it is taking much longer than anticipated for sites to become operational. Reasons for the delays are varied and are covered elsewhere in this report. Some suggestions for speeding up the process include the following:

1. Although little time is left for consortia to apply for planning grants, project managers may want to consider changing the nature of the grant or eliminating it altogether. While planning is critical to telecommunications design and development, consortia planning processes are too lengthy and delay actual implementation. Two alternatives include: (a) eliminating the planning grant entirely while building more planning into the implementation proposals, or (b) using the planning grant to cover a pilot year of operation—including equipment selection and acquisition—and initial applications that could serve as a model for the complete funding of the project.
2. Provide tighter guidelines for decision making. Many educators are at a loss in making decisions about what kind of distance learning system to acquire and, therefore, are at the mercy of vendors. We suggest that the Telecommunity staff prepare a document to help new applicants in their decisions. This document should cover the wide variety of telecommunications systems available today, and it should clearly differentiate the kinds of curriculum and instructional applications made possible by these technologies.
3. Expedite the process of grant approval. Empower the project director to authorize grants when the committee has determined what type of clarifications are necessary to the grant and what evidence will satisfy the clarification request. This move hastens the development of network-video systems within consortia and adds to the momentum that has been built by a consortia for implementing the project. Delays caused by the current approval process can debilitate applying consortia and place their initiatives in an unfavorable light with some of those it serves.
4. Provide more varied types of technical assistance to grantees. While some educators are at a loss about what equipment to purchase, we found that even more are stymied by technical problems once the equipment has been purchased. Wiring and compatibility problems seem to be the most troubling. At the same time, we encountered many knowledgeable technical people in schools whose expertise would be invaluable if there were a mechanism for sharing. A network of technology coordinators around the state could be helpful to those just starting up. Another option is to share technical information and solutions on the project's Web site and listserv, perhaps in the form of a biweekly or monthly electronic newsletter. An alternative solution would be to hire a full-time technical person as part of the Telecommunity staff who could be available to those sites needing help.

Professional Development

This evaluation shows that school districts need help with professional development. They need strategies for recruiting teachers, ideas for training teachers to use technology, and, most importantly, instruction in using telecommunications technologies to achieve optimal learning outcomes. The following are suggestions for improving professional development:

1. Distribute a newsletter (electronic or paper) from time to time that includes ideas for recruiting teachers and training teachers to use telecommunications systems.
2. Develop a videotape and/or a workshop for use at the local level that provides models for effective integration of telecommunications technologies in a wide range of curriculum areas. Such a product might also introduce an array of technology-supported assessment strategies.
3. Encourage Telecommunity staff and teachers to post project ideas, artifacts, and curriculum units

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or lessons on the project's Web site. These materials could then be adapted for use by teachers throughout the Telecommunity project.

4. Develop a resource catalog listing interactive Web sites that schools might use both for cultural and informational enrichment and for student communication across districts.

5. Conduct professional development activities that model the process of collaborative creation and delivery of instruction through videoconferencing. Such activities would include not only teachers and other school personnel but also individuals who are on the other end of the link when partnering occurs (e.g., representatives from higher education, community organizations, etc.).

Student Impact

The issue of equity is being addressed in part by some projects, but it probably needs more attention at the Telecommunity level. For example, some low-wealth school districts are not participating in distance learning consortia because of the costs involved. Evidence also suggests that some wealthier districts chose not to participate because they felt they would be on the "giving" end all the time and would receive little in return. While this attitude may be an artifact of more traditional course-based distance learning projects, it is a troubling phenomenon. Finally, schools tend to make the telecommunications systems available primarily to the most capable and highly motivated students. The following are some suggestions for addressing the issue of equity:

1. Build equity incentives into the granting process.

2. Provide models for addressing equity needs across the state of Ohio.

In anticipation of gathering student impact data once projects are fully operational, it is important to think about the kinds of outcomes that can realistically be expected from the implementation of videoconferencing technologies. We suggest the following preparations:

1. Hold a discussion among the Telecommunity staff and the TPOC to agree upon the kinds of student outcomes that will be used to determine the success of a project. Communicate these expectations to project directors for feedback and further negotiation.

2. Reach an agreement between the Telecommunity staff and the evaluation team regarding the methods used to determine student impact.

We conclude with a final word about the role of models in the Telecommunity. Throughout the summary and recommendations, we make several references to the need for models in the Telecommunity (i.e., models for effective integration of telecommunications technologies, models for the collaborative creation and delivery of instruction through videoconferencing, and models for addressing equity). The ability to use technology effectively and be creative in its application is hindered both by participants' unfamiliarity with the technology's capacity and by their lack of time to experiment with its possible applications. Our evaluation indicates that many Telecommunities would benefit from having models to guide their implementation of the project.

This recommendation is based not only on observations from the projects, but also from similar initiatives, such as the Massachusetts Corporation for Educational Telecommunications' (MCET) "The Learning Community." This project works to enable learners to use an array of telecommunications and other technologies—including two-way/multi-participant videoconferencing—in order to "learn from, interact with, and collaborate with peers and teachers from distance schools and community-based organizations." As project participants analyzed evaluation data, "the opportunity for staff to see specific examples of how to integrate new technologies into the curriculum and the time to model (not copy) new teaching/learning strategies in their own situation" was identified as a key condition for supporting interactive technology use.[10]

Identifying a model does not appear difficult. Many of the existing Telecommunity projects demonstrate creative applications of the technology and would be superb models for the rest of the Telecommunity projects. Individuals from successful Telecommunities could also identify the projects—both in and out of the state—they used as models for delivering network-video instruction. While models circumvent the creative process in some ways, a certain amount of creativity is still necessary to adapt the model successfully to achieve desired outcomes.

[10]Drexler, N. G. (1995). *Stories from the learning community: Final evaluation report.* Edcentric: Reading,MA.

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